



PSA - Personal Satellite Assistant

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The International Space Station (ISS) is a testbed for technologies that will be critical to enabling human and robotic missions to the moon, to Mars and beyond.

At the NASA Ames Research Center, researchers are developing the Personal Satellite Assistant (PSA), a free-flying spacecraft robot prototype. The PSA is designed to help astronauts inside the ISS perform some of their day-to-day tasks and to serve as a testbed for developing and refining future technologies for human-robotic interaction.

Equipped with cameras, a voice dialogue system, and environmental sensors, the ball-shaped PSA will fly freely within the ISS to monitor the onboard environment, perform inspections, document events, and generally to make sure the ISS and its crew are safe. The PSA will communicate with computers on the station and alert astronauts and mission control if a problem arises.

The PSA will assist the astronauts by helping keep track of their schedules, tasks, and scientific experiments. It will also have the capability to monitor more than 40,000 pieces of equipment and supplies on the space station once they are identified with radio-frequency ID tags. When astronauts repair something, the PSA can retrieve procedural information from the main computer and give step-by-step instructions. With its video camera, the PSA will be able to show the ground crew on Earth what is happening on the space station.

The autonomy software being developed for the PSA will be adjustable so that people can teleoperate the robot; can partially control the robot, giving it some autonomy; or the robot can operate on its own obeying high-level commands without breaking defined rules. The robot is being designed to work onboard the station but the software will be useable on robots that work outside spacecraft, in other planetary atmospheres and on planetary surfaces like Mars.



PSA Components

The intelligent software system used to command and control the PSA has many components, including:

PSA vision-based localization system: uses eight cameras on the PSA to precisely determine the PSA's location and orientation in its environment, as well as detect people and obstacles to follow or avoid.

IDEA (Intelligent Distributed Execution Agent): allows the network of intelligent agents, such as the PSA, the ISS life support systems and systems controlling science experiments, to interact.

Livingstone 2: provides continuous description of the system's behavior; provides probabilistic diagnoses to problems that cannot be directly sensed.

Europa: considers constraints when coming up with a plan generated by a person, robot or system. Used on Mars Exploration Rover Mission rovers.

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